two days was over. We had been provisioned for thirty-five."

To add to their miseries, upon their arrival at Fort Garry they learned that the steamer had broken down: so the return journey was made overland in a Red River ox-cart. However, it must have had its pleasant side, or our author could not have looked back with so much evident pleasure to the experience. Not the least striking part of the volume is a set of views contrasting the state of things then at Fort Garry with the bustle and noise of a street of the present Winnipeg. The old Selkirk settlement has disappeared. But is not something better in its place?

## COMPARATIVE MORPHOLOGY.

STUDENTS of vertebrate and invertebrate anatomy, both in this country and Great Britain, and other parts of the world where the English tongue is spoken, have much to be thankful for of late years; for during the last four or five of them have appeared in their language, either through original contribution or by translation, an exceptionally fine series of helpful handbooks of their science. Chief among these we notice upon our shelves the compact though useful little volume by Prof. F. Jeffrey Bell: the admirable manuals of Professors Martin and Mosle; the welcomed and invaluable translation of Claus's 'Text-book of zoölogy,' by Adam Sedgwick, in two volumes; the popular series contributed by Prof. A. S. Packard; a carefully revised third edition of Flower's excellent work on the osteology of the Mammalia; the favorite of all students of vertebrate anatomy, Mivart's 'Cat;' the best of little books, T. J. Parker's 'Zoötomy,' the work of the younger representative of a house the members of which now hold an unrivalled place in the science of modern times, which their extraordinarily fertile and brilliant contributions to vertebrate morphology have easily gained for them. And now comes a welcome volume from the pen of the senior son of this same family, an English translation of Wiedersheim's famous handbook of vertebrate anatomy.

It is to this last handsomely gotten up, and, almost without exception, exquisitely illustrated work, that we would here now devote a few words by way of comment and criticism. We find the book bound and printed with all that care for which the firm of Macmillan & Co. are so justly famous, and which they invariably bestow upon all their scientific publications. The work itself is divided into two parts, the first of which, entitled the 'Introduction,' comprises fifteen pages only, while the second or 'Special part' claims the remainder of the volume.

One of the principal points open for criticism in the introduction lies in its extreme brevity, and it must stand to reason that much must be sacrificed when one attempts to present the structural characters in general, and the mode of development in so important a group as the Vertebrata, in so limited a space. The great wonder is, that, notwithstanding this, the subjects treated in this part have been rendered so clearly and so thoroughly comprehensible. Nine excellent figures illustrate it, and it is completed by a helpful 'Table showing the gradual development of the Vertebrata in time.'

We find the 'Special part' divided up into sections, leading off with 'A. Integument:' followed by 'B. Skeleton;' then 'C. Muscular system;' 'D. Electric organs;' 'E. Nervous system;' 'F. Organs of nutrition;' 'G. Organs of respiration;' 'H. Organs of circulation;' and, finally, 'I. Urinogenital organs.' These several sections are found appropriately subdivided into other parts; and this plan has been found to answer the purposes both of the student and anatomist most admirably. Following as a natural sequence to such an arrangement as this, it affords, so far as the make-up of a volume is concerned, an excellent opportunity to offer a concise and convenient table of contents, presenting us with the several headings and divisions of the treatise, which has been done in the present instance. And to one at all familiar with the subject, this table of contents, supplemented, as it here is, by a wonderfully well-arranged and complete index (which latter contains but few omissions), leaves but little to be desired on this score. One word, however; for students are critical, and all are not thoroughly informed upon anatomical synonymes: so in future editions of this work it would be better to have index and text agree in every particular, and such errors, for instance, as indexing 'adrenal, 161,' and on p. 161 find 'suprarenal' only referred to, removed.

The section devoted to the treatment of the integument, though very brief, is excellent, and has been fully brought up to our present knowledge of the morphology of this structure and its appendages, in the several groups of the Vertebrata.

As we might expect, a considerable share of the work (pp. 30–111) is devoted to the 'Skeleton,' and it is ably dealt with under two headings; viz., (I.) Dermal skeleton (pp. 30–33), and (II.) The endoskeleton. Under the latter we are presented with a capital discussion of the 'Theory of the segmentation of the skull,' a fitting introduc-

*Elements of the comparative anatomy of vertebrates.* Tr. by W. NEWTON PARKER. New York, *Macmillan*, 1886. 8°.

tion to the consideration of that part of the osseous system. Notwithstanding the generosity of the authors in allotting such a goodly share of their space to the treatment of this part of their subject, it has materially suffered, in common with the other systems of the economy, by the too extensive condensation of matter which characterizes the entire volume. Space will not permit us here to show the numerous instances wherein this is evident, and an example or two must suffice. As an instance, we fail to discover even a mention of such structures as are presented us in the vestiges of a pelvis in the whales and other marine mammals; and a similar omission applies to the limbless Reptilia, as in Ophisaurus, for example. Nor (were these well-known facts alluded to) would the absence of external limbs imply that 'pectoral and pelvic arches are also wanting,' as our authors would have us believe (p. 87). And in regard to these vestiges of organs, and rudiments of the same, we are, in view of the fact of the highly important part they play in general morphology, compelled to deplore the exceedingly slight attention they have had bestowed upon them throughout the book.

Without the assistance of some such handbook as Parker's 'Zoötomy,' we are quite certain that the special student would find but little to serve him in the chapter devoted to the musculature of the trunk and its appendages, for the subject has been generalized to the last degree; nor is this section entirely free from error, as, to instance, we are told that 'no trace of a transversalis can be distinguished' in birds, — a statement that is by no means true, for a well-developed one is found in Apteryx, and this muscle is also found in some of the higher groups.

It will be out of the question to even enumerate the many slips that have been allowed to creep into the section devoted to the 'Nervous system,' certain portions of which must be read with great caution by the student, who perhaps may have to rely upon this manual as final authority.

So far as the defects among the figures are concerned, one of the principal ones to be noted is the inaccurate representation of the lancelet on p. 247, as compared with the far more correct drawing of the same animal on p. 114. Aside from these strictures, however, and many others that could be made, this work, with its long list of brilliant, and for the most part accurate, woodcuts, some of which are even colored, greatly enhancing their usefulness, its excellent bibliographical references at the end of each section, and its list of general works following the preface, and finally its admirable arrangement and clearness of diction, will be sure to commend itself to English students and readers of the subject of which it, as a whole, so ably treats. R. W. S.

## THE LIFE OF HAMILTON.

EARLY in the third volume of *Science*, at p. 23, we left Hamilton at the age of twenty-seven, young in years, but with the foundation of that superstructure, which is and always will be the marvel of mankind, well and deeply laid. Nothing can be of profounder interest than, in this second volume of his life, to watch the completion and growth to maturity of that imposing intellectual edifice so ably delineated by the accomplished author, whom Hamilton had nominated as his literary executor.

Mr. Graves finds enough in a year of Hamilton's life for a single sizable chapter, if not for more. So important an event to Hamilton as his marriage is given the prominence it ought to have: in fact, subsequent events justify his biographer in terming it 'a crisis of his life.' As might be surmised, the period of his courtship of Miss Bayly was no less a period of his courtship of the Muse; but it was not with Hamilton as it would have been with a mere poet, a period devoid of intellectual activity in other directions. His head was full of the mathematics of conical refraction, while his heart craved the satisfaction of that complete consent, long delayed, which he prized above every thing else.

On the whole, this book, as well as its companion volume, is a most diffuse one — at least, it so seems; but its compiler might well have made it even more so without undergoing in the long-run any charge of error in judgment; for every scrap of even meagre information becomes of importance, no one can tell how great, when related to a man like Hamilton, of whom it may more truly be said than of any other man of the present century, that his highest fame is still of the future. While the slow progress of the quaternion method is not a little remarkable, Hamilton appears to have been himself conscious that this might be the case, and to some extent foreshadowed it, somewhere speaking of the mathematicians of a thousand years hence, and their gratitude to him for the discovery of the new calculus.

We have nothing but the highest praise for Mr. Graves's delicate and trustworthy descriptions of Hamilton's character, and the incidents of his life. We have also to thank him for the charming glimpses he gives us of other distinguished names, in the space allowed their letters: what we see of

*Life of Sir William Rowan Hamilton.* Vol. ii. By ROBERT PERCEVAL GRAVES. London, *Longmans, Green & Co.* 8°.